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(54) Method and device for forming, by spraying, a polyurethane layer on a surface.

(57) Method and device for forming a gellified polyurethane layer on a surface, notably of a mould, by spraying a liquid reaction mixture comprising polyol and isocyanates and which has a viscosity between 20 and 2000 centipoises, wherein said mixture is sprayed in the form of a film (7') of liquid and/or of raindrops (8') of which the main part has a mean diameter (Medium Volume Diameter; "M.V.D.") which, according to the standards ASTM E 779-18, is larger than 100 microns and preferably larger than 500 microns.

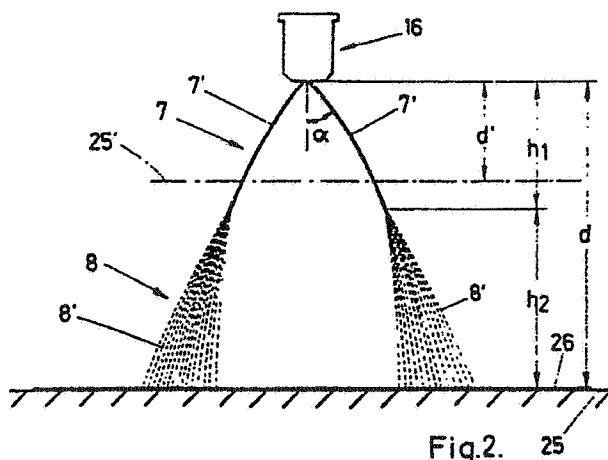


Fig.2.

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	FR-A-2 235 002 (S. SAMURA) * Claims 1-3 * ----	1,6	B 05 B 7/04 B 05 D 1/02 B 29 C 41/08
A	GB-A- 907 230 (GENERAL TIRE & RUBBER CO.) * Claim 1; figure 2 * ----	1,6,7, 10	
A	US-A-3 130 910 (D.O. SILL) * Column 1, lines 9-11; figures * ----	10	
A	US-A-3 717 306 (J.R. HUSHON et al.) * Figures; abstract * -----	10	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
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Place of search THE HAGUE		Date of completion of the search 30-10-1989	Examiner STROUD J.G.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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(54) Method and device for forming, by spraying, a polyurethane layer on a surface.

(57) Method and device for forming a gellified polyurethane layer on a surface, notably of a mould, by spraying a liquid reaction mixture comprising polyol and isocyanates and which has a viscosity between 20 and 2000 centipoises, wherein said mixture is sprayed in the form of a film (7') of liquid and/or of raindrops (8') of which the main part has a mean diameter (Medium Volume Diameter; "M.V.D.") which, according to the standards ASTM E 779-18, is larger than 100 microns and preferably larger than 500 microns.

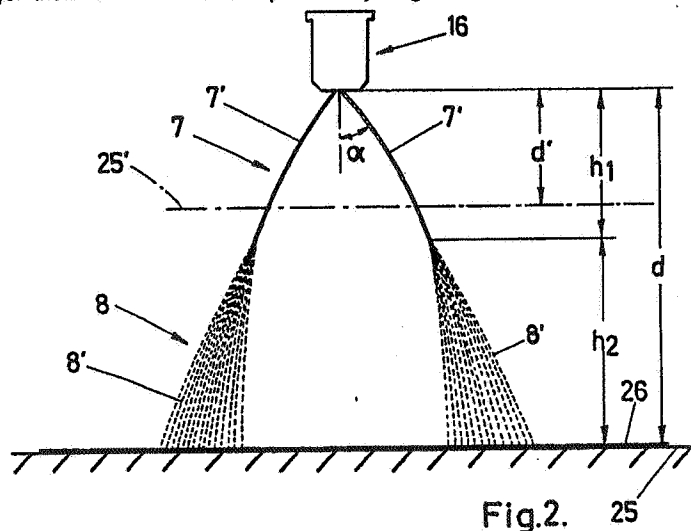


Fig.2. 25

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"Method and device for forming, by spraying, a polyurethane layer on a surface"

The invention relates to a method for forming a gellified polyurethane layer on a surface, notably of a mould, by spraying a liquid reaction mixture comprising polyol and isocyanates and which has a viscosity between 20 and 2000 centipoises.

The invention relates more particularly to a method for forming, by spraying, an elastomer layer of polyurethane which is preferably stable to light and which serves in particular for aesthetical recovering, such as the internal recovering of a vehicle. For this case more particularly the technique of the so-called "airless two components systems without solvent means" is used.

Due to the relatively high viscosity of such a reaction mixture, the relatively important tickness of the polyurethane layer, of which it is usefull that it can be applied on said surface within one and the same passage and finally the necessity of a quick gellification of the polyurethane in order to avoid the running off of the reactive material on the surface of the mould under influence of the gravitation force, it has been established that, if that known technique is applied, micro air-bubbles remain enclosed in the gellified polyurethane layer and, thereabove, due to a heterogenity by the spraying of the mixture on the surface, irregularities arised in the density and other physical characteristics, such as the colour of the thus formed layer.

The object of the invention is to provide a solution for this problem.

According to the invention said mixture is sprayed in the form of a film of liquid and/or of raindrops of which the main part has a mean diameter (Medium Volume Diameter; "M.V.D.") which, according to the standards ASTM E 779-18, is larger than 100 microns and preferably larger than 500 microns.

In a preferred embodiment of the invention said mixture is sprayed under the form of a film which extends from a mouthpiece according to an eventually somewhat cambered cone, the top angle of which being comprised between 10° and 80° and preferably between 20° and 40°.

According to a preferred embodiment of the invention said mixture is sprayed on said surface with a throughput ranging between 5 to 100 g/sec, preferably between 10 to 30 g/sec.

The invention also relates to a device for forming, by spraying, a gellified polyurethane layer on a surface, notably by applying the method described hereabove.

The device is characterized by the fact that it comprises a mouthpiece in the head of which an injector is mounted showing a funnel-shaped cavity, which, at the one hand, issues forth into a substantially cylindrical channel having a lenght of 0 to 5 mm, and preferably of 0.1 to 2 mm and connecting this cavity with an injection aperture and, on the other hand, has a connection to a mixture chamber wherein reaction components for obtaining polyurethane are introduced, whereby substantially at the entrance of said funnel-shaped cavity means are provided for conducting substantially according to a screw or whirl movement the already formed polyurethane and/or the reaction components through said injection aperture.

Other particularities and advantages of the invention will become clear from the description given hereunder which refers to the figures which relate to some particular embodiments of the method and the device according to the invention ; the description is only given by way of example and does not limit the invention ; the references used hereunder relate to the figures.

Figure 1 gives a schematic view of a general method according to the invention.

Figure 2 gives a schematic view of a longitudinal section of a liquid beam obtained by applying the method according to the invention.

Figure 3 is a view in cross-section of a part of a first embodiment of the device according to the invention for applying a method according to the invention.

Figure 4 is, at a larger scale, a cross-section of a mouthpiece of the device illustrated in Figure 3.

Figure 5 is a side-view, with partial cross-section, of a particular component of the mouthpiece according to figure 4.

Figure 6 is a view according to the line VI-VI of figure 5.

Figure 7 is a longitudinal section according to the line VII-VII of figure 8 of a second embodiment of a mouthpiece according to the invention.

Figure 8 is a front view according to the line VIII-VIII of figure 7.

Figure 9 is, at a larger scale, a front view according to the line IX-IX of figure 10 of a particular component of the mouthpiece according to the figures 7 and 8.

Figure 10 is a side view of the same component according to the line X-X of figure 9.

Figure 11 is a back view according to the line XI-XI of figure 10 of the component.

Figure 12 is a front view of the mouthpiece according to a third embodiment of the device according to the invention.

Figure 13 is a longitudinal section according to the line XIII-XIII of figure 12.

Figure 14 is a similar cross-section, at a larger scale, of a particular component of the embodiment according to figures 12 and 13.

Figure 15 is a back view according to the line XV-XV of figure 14.

5 Figure 16 represents partially longitudinal sections of the mouthpiece according to figures 12 and 13 before it is mounted on another part of a particular embodiment of the invention.

Figure 17 is a front view according to line XVII-XVII of figure 18, of a further embodiment of a particular component according to figure 9.

Figure 18 is a lateral view with a partial cross-section according to the line XVIII-XVIII of figure 19.

10 Figure 19 is a back view, according to the line XIX-XIX of figure 18.

Figure 20 is a longitudinal section according to the line XX-XX of figure 21 of a further embodiment of a mouthpiece according to the invention.

Figure 21 is a front view according to the line XXI-XXI of figure 20.

In the different figures the same references relate to the same or analogous elements.

15 The invention relates to a method for forming a gellified polyurethane layer on a surface, more particularly on an adequate surface of a mould.

An object of the invention is in particular the formation, in a mould, of an elastomer layer of polyurethane which is stable to light and which has a minimal thickness of 0.3 mm and preferably ranging between 0.5 and 2 mm, so that a print is obtained which serves as aesthetical recovering, in particular for
20 orning the ashboard of automobiles. The elastomer layer is preferably formed according to the so-called "airless two-component-system in absence or substantially absence of solvent means".

Figure 1 represents a schematic view of the applied method.

In a first step, the two components, i.e. polyol and isocyanates, are proportioned starting from a tank 1A, respectively 1B, by means of gauge pumps 2A, respectively 2B, for consequently, in a second step, to
25 be brought at an adequate temperature by means of a heat exchanger respectively 3A and 3B before to be mixed in a mixing head 4 on which a mouthpiece 16 is connected from which a beam of the thus formed reaction mixture is sprayed on a mould surface in order to form said elastomer layer.

According to the invention, the reaction mixture is sprayed under the form of a film and/or of raindrops of which the largest part has a mean diameter (Medium Volume Diameter) according to the standards
30 ASTM E 779-18 higher than 100 microns and preferably higher than 500 microns.

As has been presented in figure 2, the beam of liquid which is sprayed out of the mouthpiece, comprises generally two parts 7 and 8 of which the physical aspect is substantially different. So the part 7, which is the closest to the mouthpiece, is formed by a film 7' which extends according to the surface of a cone with a cross-section having the form of a circle or an oval, depending on the kind of the used
35 mouthpiece, while in the part 8 that film is broken up into drops 8'.

Generally one tries to maintain a distance d between the mouthpiece 16 and the surface on which the elastomer has to be formed, which distance lies between 0.5 cm and 30 cm and preferably between 15 and 20 cm.

Figure 2 shows, in plane lines, a first advantageously case where the surface 25 to be covered by an
40 elastomer layer 26 is at a distance d of the mouthpiece 16, which is larger than the height h_1 of the part 7 of the diameter of the reaction mixture and, in broken lines, a second case wherein the surface 25' is at a distance d' which is smaller than that height h_1 . In the first case, the layer 26 is formed by the drops 8', while in the second case it is formed by the film 7'.

The height h_1 of that part 7 is, for a same mouthpiece, essentially determined in function of the
45 viscosity of the reaction mixture of the angle α and of the throughput of the sprayed liquid.

Thus those parameters are adjusted on an advantageously manner such that the height h_1 of part 7 range between 0.5 and 20 cm.

Moreover it has to be noted that preferably this mixture should be sprayed under the form of a film which extends starting from the mouthpiece 16 and according to a hollow possibly somewhat cambered
50 cone of which the top angle α is comprised between 5° and 80° and preferably between 20° and 40° .

However if, for example, for pratical reasons, the reaction mixture has to be distributed substantially under the form of drops over the surface to be covered, it has been established that the most favourable results can be obtained when the largest part of those drops 8' shows a relatively large mean diameter, which is mostly comprised between 1000 and 5000 microns, and preferably between 500 and 3000
55 microns.

The height h_2 of this part 8, compared to that of the part 7, can be relatively important if the reaction mixture is sprayed with a relatively limited throughput on the surface to be covered.

As has been schematically represented in figure 2, starting from a certain distance with respect to the

part 7, the drops spread themselves, on an substantially uniform manner over a large part of the cross-section of the cone, in the part 8 where they are formed. in contrast to what is the case in the part 7 where the liquid essentially extends in the form of a hollow cone.

Figures 3 to 6 relate to a spray-gun, which according to the invention can be used for applying the method described above.

The gun comprises essentially a mixing chamber 9 having an input for polyol 10, for isocyanate 11 and for rinsing means 12, which can be closed by means of a ball-valve.

The injectors 13 and 14 for the polyol and the isocyanates are respectively provided between the inputs 10 and 11, on the one side, and the mixing chamber 9, on the other side. Those injectors issue forth in that chamber 9 according to opposite directions and thus enable the introduction with a relatively high speed of the polyol and the isocyanates in counter-current in that chamber.

The mixture thus obtained in that chamber is further conducted to a mouthpiece 16 by means of a conduct 15.

The figures 3 to 6 relates to a first embodiment of such a mouthpiece.

That mouthpiece 16 comprises a central core 17 which is screwed in a cylindrically shaped hollow body 18, in such a manner that a ring-shaped admission chamber 19 is formed around that core 17. The core 17 only shows thus at its back-part an external screw thread 17' which cooperates with the internal wall of the hollow body 18 and which is provided with a screw thread 18'. The core 17 shows an input piece having a truncated cone-shaped part 20 which penetrates in a funnel-shaped cavity 27 of the injector 21 provided with an injection aperture 22, which injector 21 is mounted on cone-shaped perforation in the head of the mouthpiece 16.

The truncated cone-shaped part 20 is, as has been clearly shown on a large scale in figures 4, 5 and 6, provided at its wall with four grooves 23 allowing the injection apertures 22 to be connected to the ring-shaped chamber 19.

The four grooves 23 generally show a depth and a thickness of 0.1 mm to 2 mm and preferably of 0.3 mm to 1 mm. They are further equally distributed over the truncated cone-shaped part 20 of the core 17 and are excentrical and oriented according to a screw-form in such a manner that the reaction mixture, originating from chamber 19, is introduced according to a screw or whirl movement in the funnel-shaped cavity 27 of the injector 21, as clearly seen from the relative direction of the arrows 28, shown in figures 4 to 6.

The funnel-shaped cavity 27 is elongated by a cylindrically shaped channel 29 which issues forth in the injection aperture 22.

According to the invention, the cylindrically shaped channel 29 shows a lenght from 0 to 3 mm and preferably between 0.1 and 0.6 mm. It has indeed been established, on a somewhat unforeseen manner, that the form of the reation mixture beam which is formed at the output of the mouthpiece 16, is essentially determined by the length of the cylindrically shaped channel 29 for a reaction mixture with a same viscosity. More particularly an adequate choice of that length permits to obtain at the output of the mouthpiece a beam which has the characteristics defined hereabove, more particularly as has been illustrated in figure 2.

It is essential, according to the invention, that the cylindrically shaped channel be relatively short compared to the length of that part by the known mouthpieces, which are for example used for spraying paints having a viscosity beneath 20 centipoises. In some cases this may be totally inexistent. It has thus been established that, when the cylindrically shaped channel is relatively long, it is no longer possible to form a film of liquid at the output of the mouthpiece 16 which film of liquid extends according to the surface of a cone, as has been explained hereabove.

The injection aperture 22 shows generally a diameter of 0.2 to 5 mm and preferably of 0.7 to 2 mm.

The truncated cone part 20 of the core 17 even as the injector 21 are preferably manufactured in tungstene carbide, though other materials with enough hardness and resistance against use can also be used.

In the figures 7 to 11 a second embodiment of a mouthpiece according to the invention is illustrated.

The concept of that mouthpiece is in a way similar to those shown in figures 3 to 6, whereas the construction thereof shows some differences.

It is a main object to realize a mouthpiece of which the outer dimensions are as small as possible, in order to easily and in an efficient way reach the places of a surface to be covered with polyurethane and which are the most difficult to reach.

In the second embodiment, the core 17 is directly mounted on a cylindrical extension piece 21' of the injector 21 and there is spared in the cylindrical part 20' of the core, which is backwards situated with respect to the funnel-shaped cavity 27, a sufficiently large diametrically extending groove 19 which forms said supply chamber. That supply chamber is then also in connection, at the one hand, with the grooves 23

provided in the truncated cone-shaped part 20 and, at the other hand, with the mixture chamber 9. The part 20 of the core 17 shows only two grooves 23 which extend diametrically opposite against each other. If required, more grooves can of course be provided. In the case of four grooves, for example, it is enough to provide in the part 20' of the core 17 two grooves 19 which extend perpendicular to each other which

connect these grooves 23 to each other.

For certain applications, where there is sprayed in shallow small holes or moulds, it is important that a small spray pattern be used, that is to say where the angle α (see figure 2) is relatively small, in order to minimize the losses ("overspray"). Therefore, according to the invention, for that kind of application, use is advantageously made of the injector 21 of which the inclination angle β in the injector 21 is relatively sharp and smaller than 30° , while the dimensions h' and h'' are enlarged.

The figures 12 to 15 relate to a third embodiment of a mouthpiece 16 according to the invention. This embodiment distinguishes from the other essentially by the fact that there is no central core 17 present and that the grooves 23 are provided in the injector 21 in the border 30 of the funnel-shaped cavity 27 of the latter. The border 30 joints the flat inner face 31 of the hollow body 18 wherein said injector 21 is screwed. The latter further shows at its frontside a relatively high upstanding border 32 which is provided with an external screw thread 32' serving to fix the injector 21 in the body 18. In this manner the injection aperture 22 is somewhat sunk in the body 18 and at the other side of that aperture 22 a protection zone 33 is formed for the liquid beam at the output of the injector.

In order to realize in an advantageously manner the object of the latest two embodiments as set out hereabove, it could be important, according to the invention, to fix the mouthpiece 16 at the free-end of a tube-shaped element 34 which connects the mouthpiece to the mixing chamber 9, via the conduct 15. That element can for example be formed by a static mixer as has been showned in figure 16 and which is known on its own.

Herewith is it important that the outer diameter of the mouthpiece 16 itself and the connexion means of the latter with the element 34 are not substantially larger than that latest.

According to the invention the body 18 of the two latest embodiments is also essentially tube-shaped except perhaps for the head 35 thereof, which is flattened and forms the free end of the mouthpiece, and the extremity of the hollow body 18 which is situated at the opposite side of the head 35 is provided with a screw thread 36. The tube-shaped body shows a longitudinal perforation 39 which extends starting from the supply chamber 19 until the extremity of the body situated at the other end.

In this manner, the mouthpiece 16 can easily be screwed on the free end of that element 34, which is thus also provided with a screw thread.

In a second embodiment of the mouthpiece, there is an internal screw thread 36, in such a manner that the body 18 thereof is screwed on the outer side of element 34, while in the third embodiment that screw thread is external so that, in that case, the free end of the hollow body 18 is screwed in the free end of the element 34, as has been showed in figure 16.

The axis of the cylindrical channel 29 with the injection aperture 22 is perpendicular on the one of the tube-shaped element 34. That latest shows at the extremity, situated at the other side of its free extremity, a collar 37 which is fixed on the mixer head 4, as has been illustrated in figure 3, by means of a shell-shaped bolt 38.

In figures 17 to 19, another particular embodiment of the core 17 is illustrated which could, for example, replace the core of the second embodiment of the mouthpiece according to the invention and which has been illustrated in figures 7 to 11.

That core distinguishes from the one illustrated in figures 9 to 11 by the fact the supply chamber 19 is formed by a central sparing instead of a groove which extends diametrically in the back part 20'. That central sparing is connected, via cylindrically shaped perforations 40, with the four grooves 23, which are equally disposed over the truncated cone-shaped wall of the part 20 of the core 17 and which are oriented screw-formed with respect to the axis of that part 20. These perforations, which have been carefully realized, extend from the central chamber 19 to the grooves 23.

On a rather unexpected way it has been established that, thanks to the use of such a core, an extremely stable and regular spray pattern has been obtained and this in such a manner that the cone of liquid formed during the spraying, as has been illustrated in figure 2, shows a substantially circular cross-section perpendicular to its axis and a thickness of the wall which is substantially everywhere constant in its cross-section. There upon, such a core is much more easier to reproduce.

Finally, figures 20 and 21 show a further embodiment of a mouthpiece 16 according to the invention. This mouthpiece is distinguished from the previously presented one by the presence of means enabling to control the spray pattern independantly of the throughput, more particularly the surface of the on its axis perpendicular cross-section of the sprayed cone of liquid, as schematically illustrated in figure 2.

According to a particular embodiment of the invention, this is realized by air controll, that is to say by means of a curtain of compressed air which is formed around the sprayed cone of liquid and which enables, by controlling the throughput of the compressed air, to apply a well determined lateral pressure on the face of the cone 7 (see figure 2) and to bend it towards inside.

5 Thereto there are provided, around the cylindrically shaped hollow body 18, wherein the non-represented injector 21 with the core 17 placed therein has to be screwed in a manner, as has been illustrated in figure 7, in said mouthpiece 16 a number of small holes 41, which are situated on a concentric circle with the injection aperture 22 of the injector 21 and which oriented according to a same angle towards the axis 42 of that injection aperture 22.

10 The small holes 41 are situated in an oblique surface at the inner side of a border 43 of said body which is upstanding with respect to the axis 42 and which has a communication with a ring-shaped chamber 44 which extends around the body 18 and on which a compressed air conduct 45 is connected. By controlling the throughput of the compressed air supplied via the conduct 45, the pressure of the compressed air stream can be controlled, this compressed air stream being oblique oriented on the outer side of the cone wall 7, by means of the holes 41, according to which that cone wall can be bent towards the axis 42.

The invention is again of interest for applications wherein there is sprayed in shallow small moulds and where the losses of spraying have to be minimized.

15 If use is made of a core 17 and an injector 21, as has been illustrated in figures 17, 19 and 7, it is possible to control by means of computer control, beside the displacement speed of the mouthpiece 16 in function of its place and with respect to the mould, as well the throughput liquid at the injection aperture 22 as the surface of the perpendicular cross-section of the cone in function of the place of the mouthpiece 16 with respect to the mould on which there has to be sprayed.

Hereafter the working conditions are given by means of two practical examples for spraying a reaction mixture of polyol, isocyanates and polyurethane.

Parameters	Example 1	Example 2
Throughput of the reaction mixture (g/sec)	25	10
Pressure of the polyol (bar)	150	150
Pressure of the isocyanates (bar)	100	100
Dimension of the drop (μ) (M.V.D. values)	2000	1000
Angle of the cone ($^{\circ}$)	35	27
Height h_1 of the cone (mm)	50	25
Distance d between the mouthpiece 16 and the surface 25 to be covered (mm)	200	100
Number of grooves 23 in the truncated cone-shaped input piece 20 of the mouthpiece		
16	4	2
Depth of the grooves (mm)	0.50	0.30
Thickness of the grooves (mm)	0.50	0.30
Diameter of the spray aperture 22 (mm)	1.52	0.71
Length of the cylindrical part 29 (mm)	0.6	0.2

Examples of reaction mixtures :

It concerns here more particularly mixtures which have been the object of the Belgian patents n°
5 852,337 and 882,058, which also belong to the applicant.

Example 1

10

1) Characteristics of the polyol (first component).

15

20

25

30

35

40

45

50

55

Formula in parts by weight

Polyether-triol which is obtained by adding
 popylene oxide and ethylene oxide to glycerine
 as initiator (OH index : 35 ; ratio on primary
 OH radicals : 80%)

100

Ethylene-glycol

5

N'N-dimethylbutadiamine :

5

Lead-octoate (33% lead metal)

0.7

Colour paste :

5

115.7

Characteristics

Viscosity at 25°C in MPa.s :

1170

Viscosity at 45°C in MPa.s :

300

Viscosity at 45°C in MPa.s :

150

Viscosity at 65°C in MPa.s :

150

Density (21°)

1.02

2) Characteristics of the isocyanate (second component)Formula (in parts by weight)

Quasi-prepolymere (100 parts isophorondiisocyanate
 + 13.28 parts dipropylene glycol

- end ratio at NCO group : 26%) :

67.1

Dimethylstanodineodecanoate

1

68.1

Characteristics

Viscosity at 25° in MPa.s :

1450

Viscosity at 45° in MPa.s :

350

Viscosity at 65° in MPa.s :

50

Density (21°)

1.07

$$\text{Ratio } \frac{\text{polyol component}}{\text{isocyanates component}} = \frac{115.7}{68.1} = 1.7$$

Example 2Characteristics of the polyol (first component)I. Formula (in parts by weight)

Polyether-triol of the same type as in Example 1 :

90

Dabco 33 Lv (triethylene diamine ; 33 %

in solution of DPG) :

2.25

	Butane-diol	7.9
	Colour paste	<u>5</u>
5		105.15

Characteristics

	Viscosity at 25° in MPa.s :	1060
10	Viscosity at 45° in MPa.s :	320
	Density (21°C) :	1.02

2) Characteristics of the isocyanate (second component)

Formula

15	Isocyanates RMA 200 (Upjohn) :	43.5
----	--------------------------------	------

Characteristics

	Viscosity at 25°C in MPa.s :	620
20	Viscosity at 45°C in MPa.s :	126
	Density (21°C) :	1.21

25 Ratio : $\frac{\text{polyol component}}{\text{isocyanates component}} = \frac{105.15}{43.5} = 2.42$

30 From the different experiments, which have been given in the examples hereabove, it can be concluded that by using a method and a device according to the invention, it is possible to obtain a substantially complete uniformity with respect to the distribution of the elastomer layer on the surface to be covered, to the homogeneity of the colour and of other physical characteristics of the layer and this by one single passage of the mouthpiece over the surface.

35 The invention is naturally in no way limited to the examples given hereabove and within the scope of the patent application several changes could be envisaged, under more with respect to the composition of the used components and the construction of the mouthpiece. Thus in principle the static mixer 34 has to be provided between the mixture chamber 9 and the mouthpiece 16, for example when the homogeneity of the mixture leaving the chamber 9 is insufficient.

40 Also several constructions of the mouthpiece 16 are possible and eventually other means than grooves 23 can be used in order to realize the screw or whirl movement of the liquid to be sprayed through the spray aperture 21.

Claims

45 1. A method for forming a gellified polyurethane layer on a surface, notably of a mould, by spraying a liquid reaction mixture comprising polyol and isocyanates and which has a viscosity between 20 and 2000 centipoises, characterized in that said mixture is sprayed in the form of a film (7') of liquid and/or of raindrops (8') of which the main part has a mean diameter (Medium Volume Diameter; "M.V.D.") which, according to the standards ASTM E 779-18, is larger than 100 microns and preferably larger than 500 microns.

50 2. A method according to claim 1, characterized in that said mixture is sprayed in the form of a film (7') which extends from a mouthpiece (16) according to a possible somewhat cambered cone, the top angle α of which is being comprised between 5° and 80 degrees and preferably between 20° and 40°.

55 3. A method according to claim 2, characterized in that said mixture is sprayed in the form of a film (7') which extends from a mouthpiece (16) according to a possible somewhat cambered cone, the height of the cone being comprised between 0.5 and 20 cm.

4. A method according to claim 1, characterized in that raindrops (8') are formed the main part of which have a mean diameter comprised between 500 and 5000 microns, preferably between 500 and 300 microns.

5. A method according to anyone of the claims 1-4, characterized in that said mixture is sprayed on the surface (25) with a throughput in the order of 5 to 100 g/sec, preferably 10 to 30 g/sec.

6. A method according to anyone of the claims 1-5, characterized in that, by spraying said mixture on said surface (25), there is formed a polyurethane layer with a minimum thickness of 0.3 mm, preferably between 0.5 and 2 mm.

7. A method according to anyone of the claims 1-6, characterized in that, there is used a reaction mixture of polyol, isocyanates and addition substances which permits to form a gellified polyurethane layer (26) which is substantially stable to light.

8. A method according to anyone of the claims 1-7, characterized in that, said mixture is sprayed with a throughput which varies in function of the place in the mould, whereby on zones of the mould which are relatively easy to spray a maximum throughput is used and on zones which are relatively difficult to reach and to spray a minimum throughput is used.

9. A method according to anyone of the claims 2-8, characterized in that along the outer sides of said cone there is created a stream of compressed air having an adjustable speed, which stream enables the cone wall formed by the drops or the film of the sprayed mixture, to be bend.

10. Device for forming, by spraying, a polyurethane layer on a surface, more particularly a device for the application of a method according to one of the claims 1 to 9, characterized in that the device comprises a mouthpiece (16) in the head of which there is mounted an injector (21) which determines a funnel-shaped cavity (27), which, at the one hand, issues forth into a substantially cylindrical channel (29) having a length of 0 to 5 mm, and preferably of 0.1 to 2 mm, and connects this cavity (27) with an injection aperture (22) and, at the other hand, has a connection to a mixture chamber (9) wherein reaction components for obtaining polyurethane are introduced, whereby substantially at the input (27') of said funnel-shaped cavity (27) means are provided for conducting, substantially according to a screw or whirl movement, through said injection aperture (22) the already formed polyurethane and/or the reaction components.

11. Device as claimed in claim 10, characterized in that, said means comprise grooves (23), which are substantially equally disposed at the input (27') of the funnel-shaped cavity (27) and which are oriented substantially according to the form of a screw with respect to the axis of the cavity.

12. Device as claimed in claim 11, characterized in that, a central core (17), having a truncated cone part (20) oriented towards that cavity, is mounted at the input of the funnel-shaped cavity (27), and whereby said grooves (23) are provided in the truncated cone wall of that part (20) and connect the funnel-shaped cavity (27) with a supply chamber (19) which at his turn has a connection to the mixture chamber (9).

13. Device as claimed in claim 12, characterized in that, said core (17) is mounted in a substantially cylindrical hollow body (18), whereby said supply chamber (19) presents a ring-shaped space which extends in said hollow body (18) around the part (20') of the core (17) which is situated at the backwards with respect to the funnel-shaped cavity (27).

14. Device as claimed in claim 12, characterized in that the core (17) is mounted in the injector (21) and that in the part (20') of the core (17) which is situated at the backwards with respect to the funnel-shaped cavity (27) there is provided a supply chamber (19), which is connected, at the one hand, with the grooves provided in the truncated cone part (20) and, at the other hand, with the mixture chamber (9).

15. Device as claimed in claim 11, characterized in that the grooves (23) are provided in the injector (21), on the border of the funnel-shaped cavity (28) thereof.

16. Device as claimed in claim 12, characterized in that the grooves (23) are connected to a central supply chamber (19) which is provided in said backward part (20') of the core (17), via substantially cylindrical perforations (40) which extends from said chamber (19) to said grooves (23).

17. Device as claimed in claim 16, characterized in that four substantially identical grooves (23) are equally disposed over said truncated-cone wall of the part (20) of the core (17), which grooves are screw-shaped oriented with respect to the axis of said part (20).

18. Device as claimed in anyone of the claims 10-17, characterized in that said mouthpiece (16) is mounted on the free end of a tube-shaped element (34) which forms a connection between the funnel-shaped cavity (27) and the mixture chamber (9).

19. Device as claimed in claim 18, characterized in that the tube-shaped element (34) is at least partially formed by a static mixer.

20. Device as claimed in anyone of the claims 18 or 19, characterized in that, said mouthpiece (16) is screwed on the free end of said tube-shaped element (34).

21. Device as claimed in anyone of the claims 18-20, characterized in that, the axis of said cylindrical channel (29) with said injection aperture (22) is substantially perpendicular on the one of said tube-shaped element (34).

22. Device as claimed in anyone of the claims 18-21, characterized in that said mouthpiece (16) is also tube-shaped and comprises an external diameter which is at most equal to 10 mm.

23. Device as claimed in anyone of the claims 10 to 22, characterized in that the grooves (23) shows a depth and a thickness of 0.1 to 2 mm and preferably 0.3 to 1 mm.

24. Device as claimed in anyone of the claims 10 to 23, characterized in that the injection aperture (22) has a diameter of 0.1 to 5 mm and preferably of 0.7 to 2 mm.

25. Device as claimed in anyone of the claims 10 to 24, characterized in that, around said injection aperture (22) small holes (41) are provided which are disposed in a substantially concentric circle in said injection aperture, said holes being all oriented according to a substantially same angle towards the axis of said injection aperture (22) and which joint on a ring-shaped chamber (44) feeded with compressed air, which chamber extends around the core (17).

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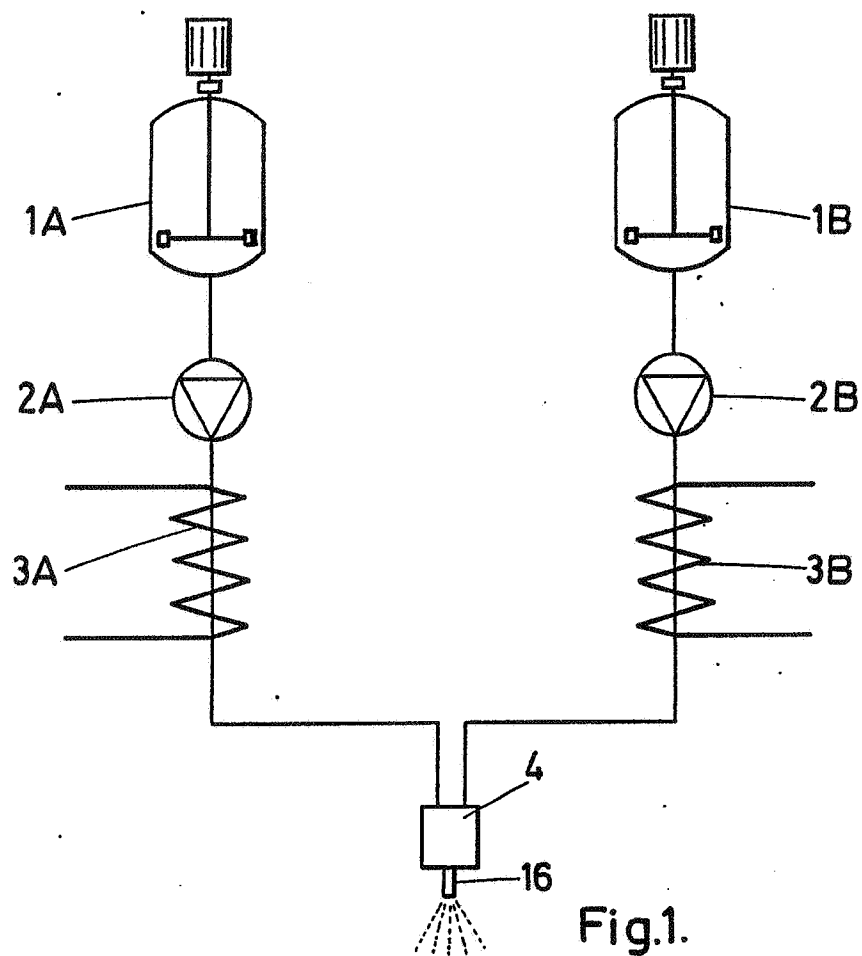


Fig.1.

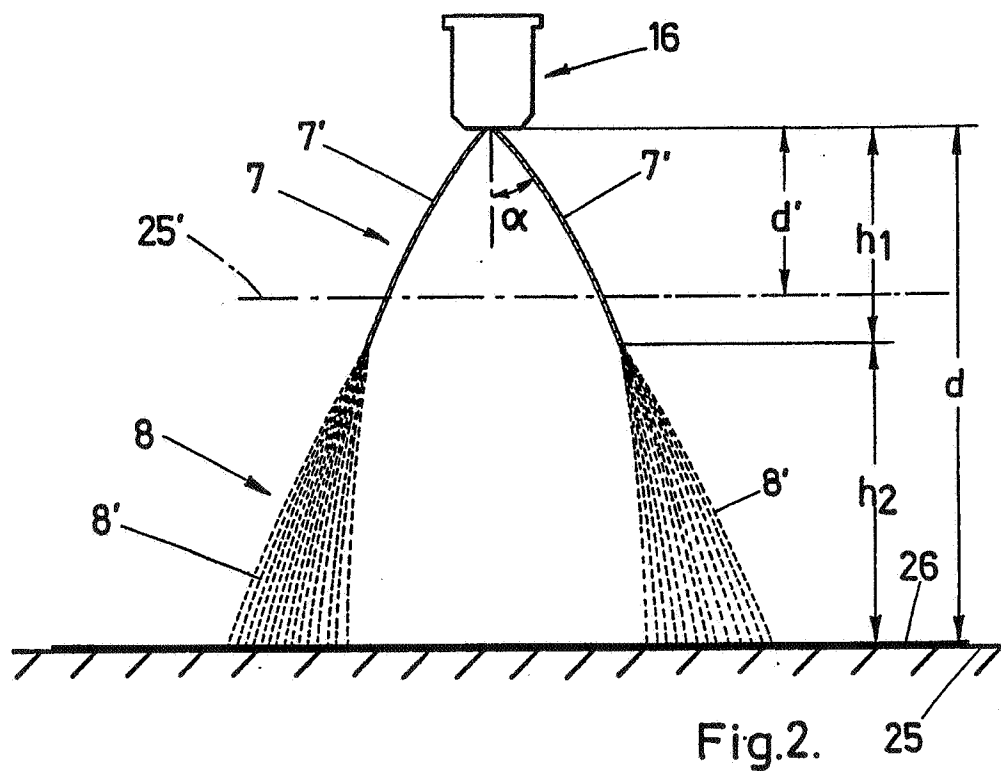


Fig.2.

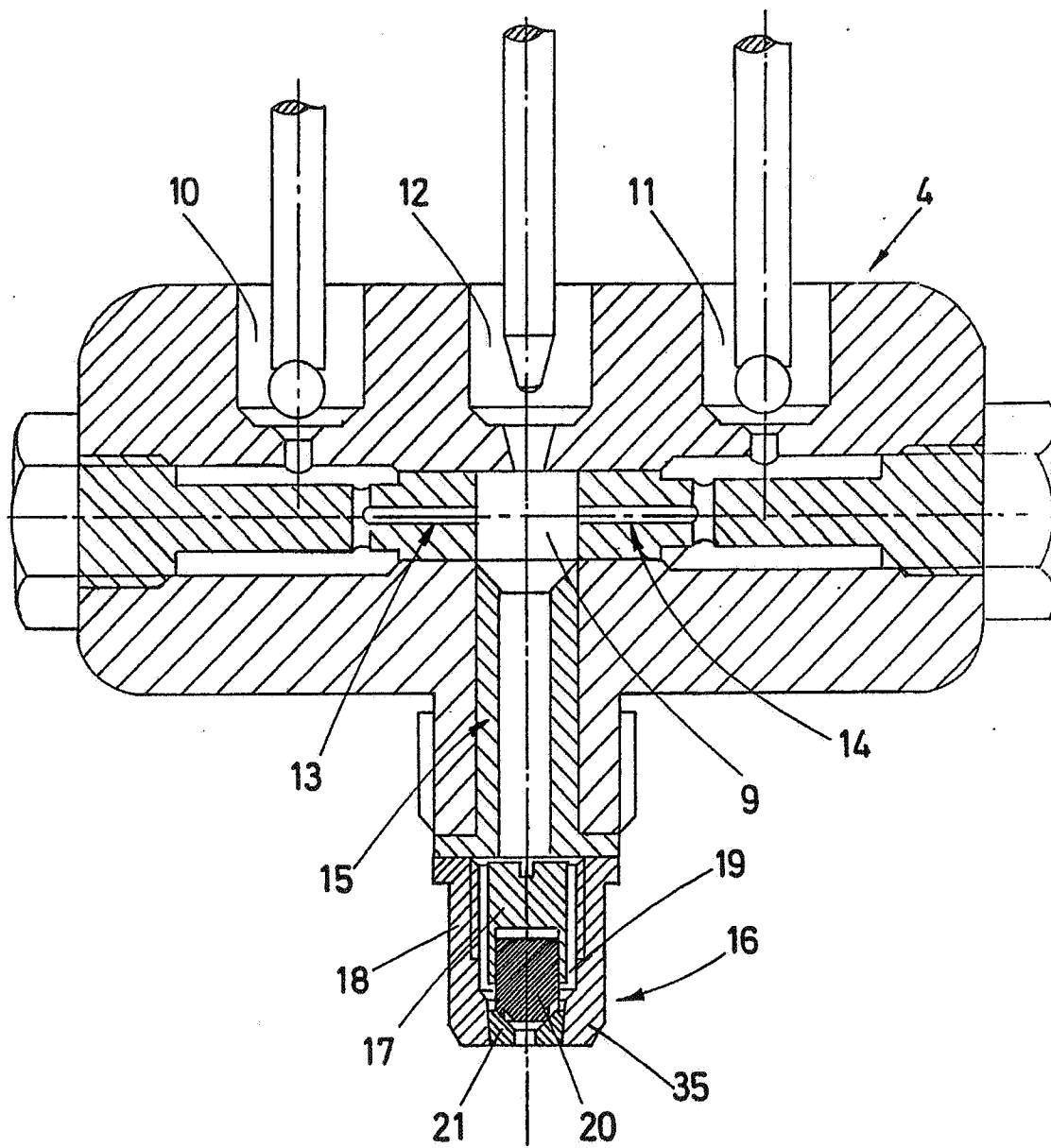
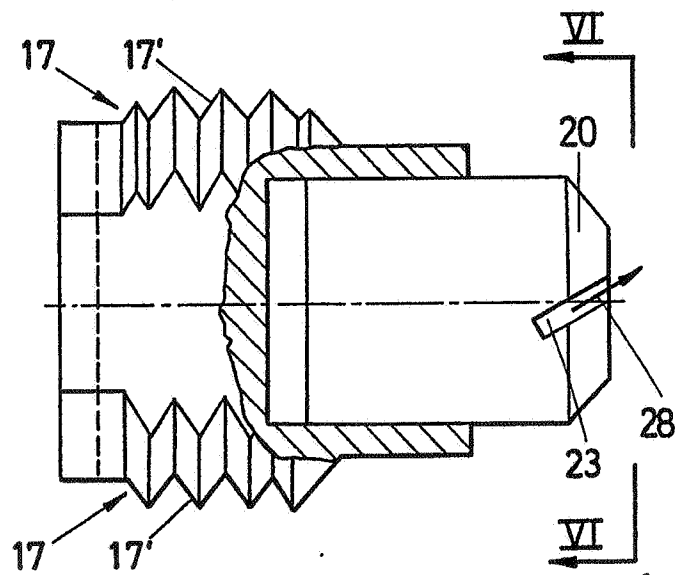
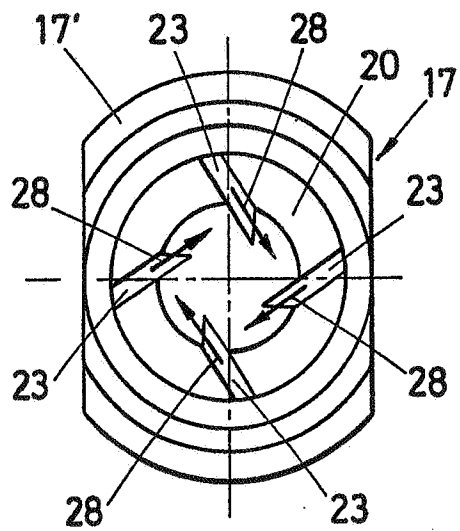
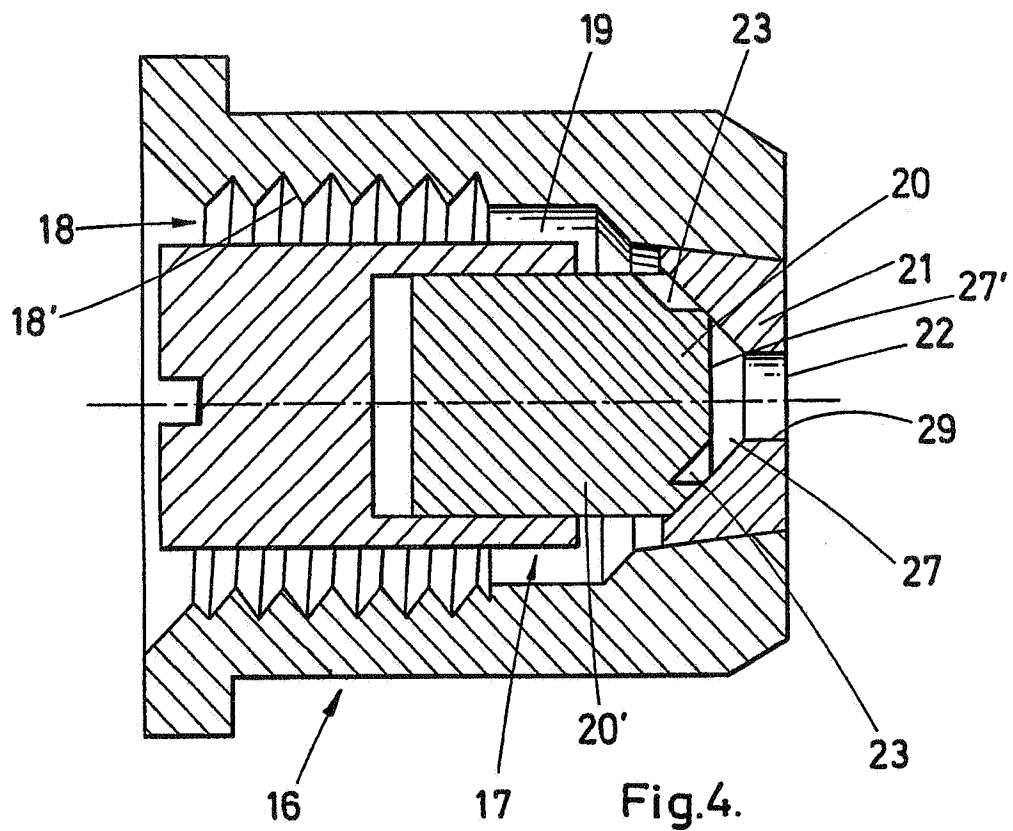
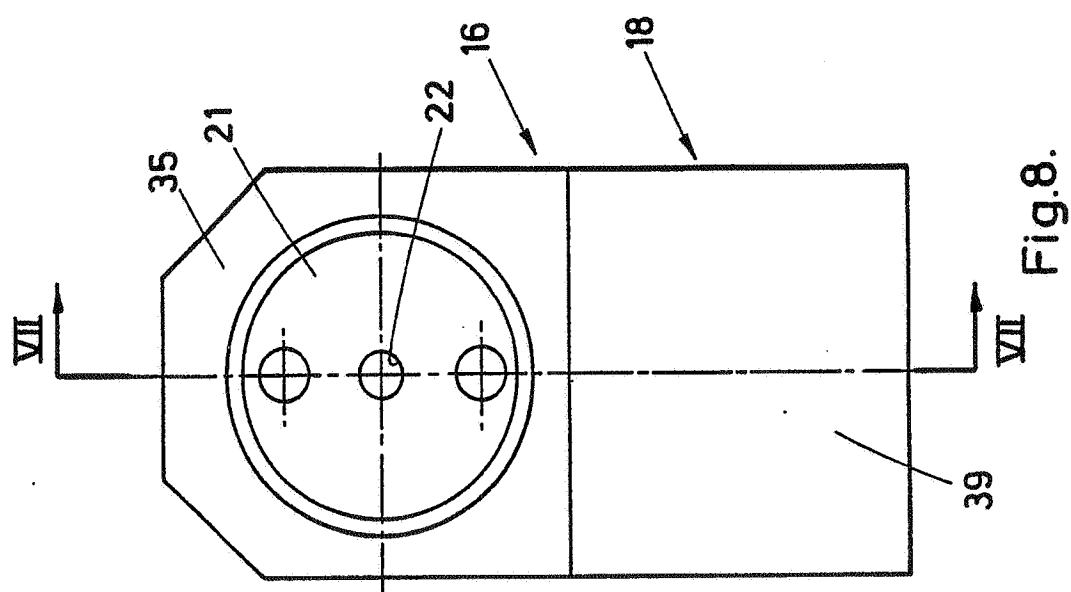
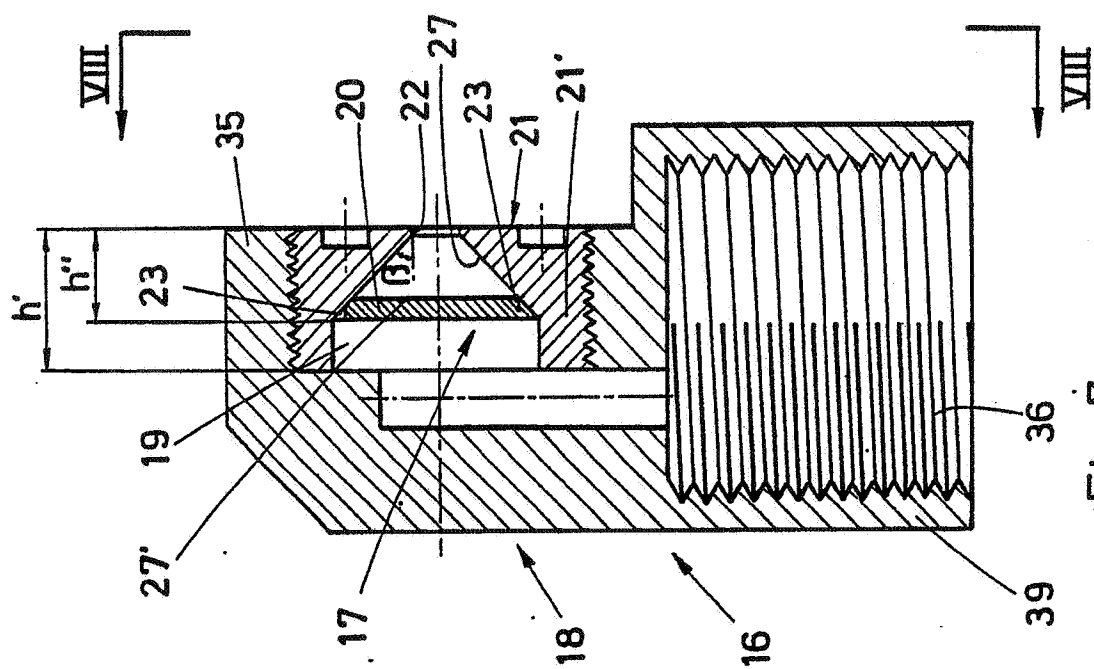
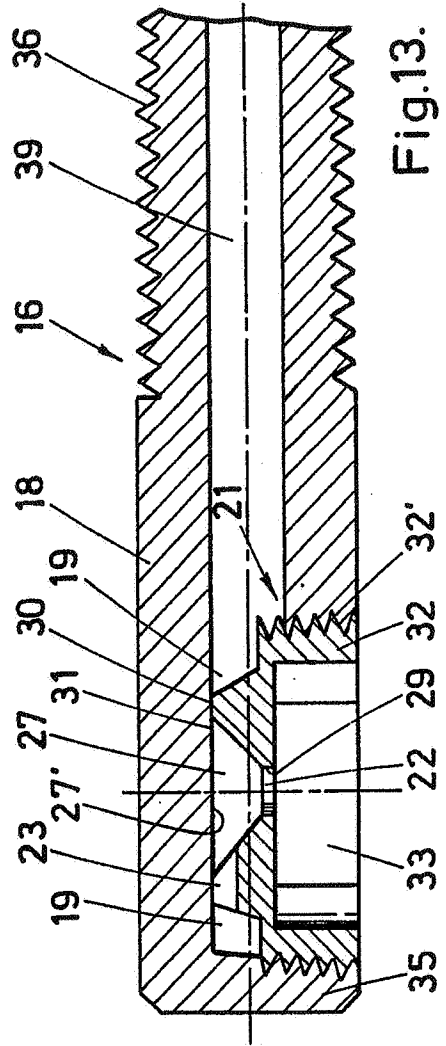
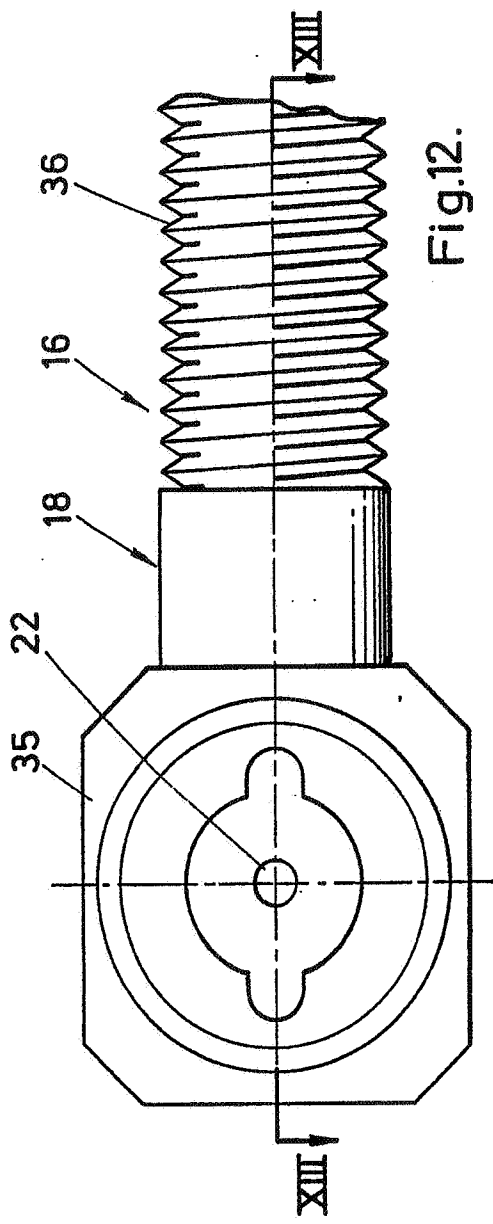
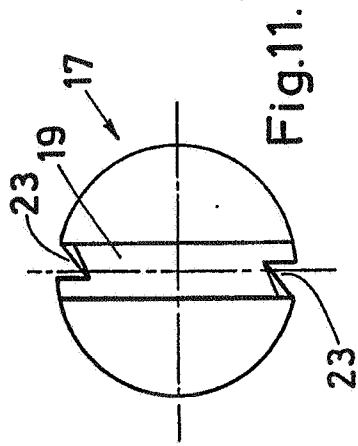
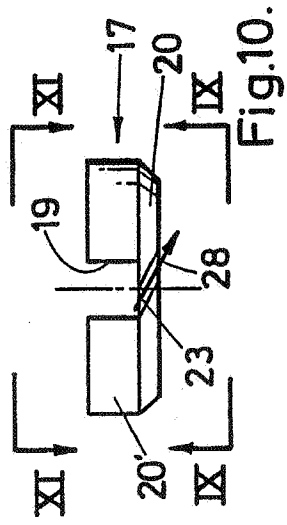
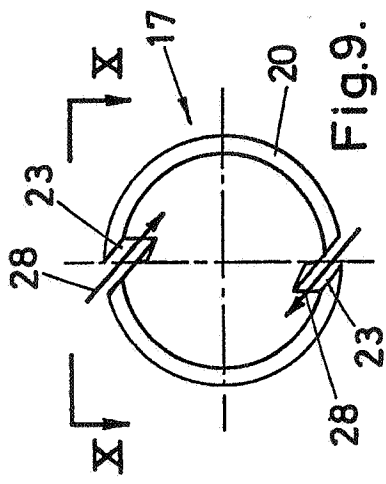


Fig.3.







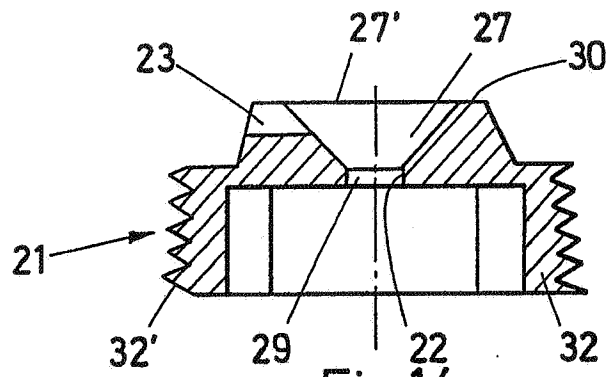


Fig.14.

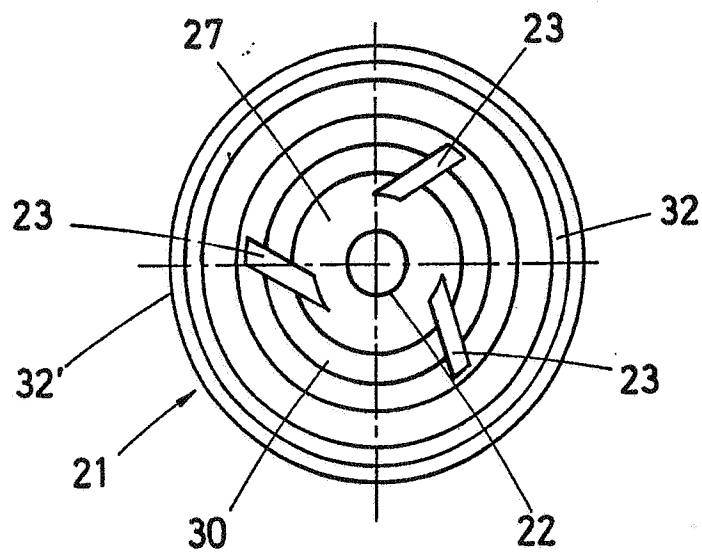


Fig.15.

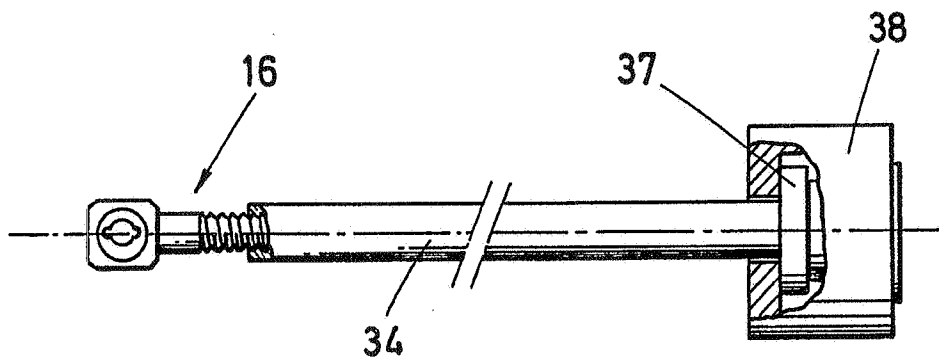


Fig.16.

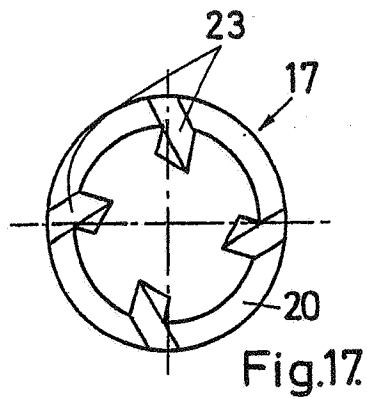


Fig.17

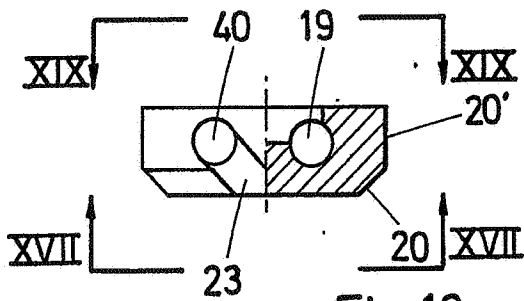


Fig.18.

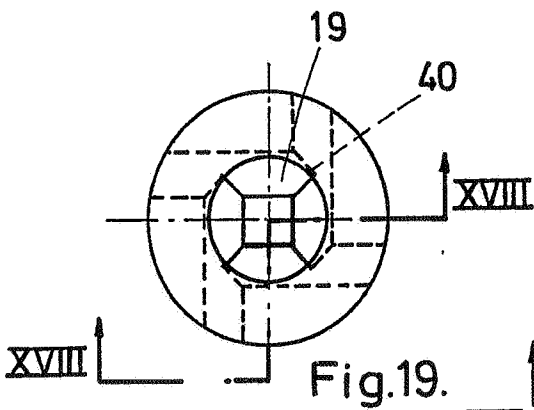


Fig.19.

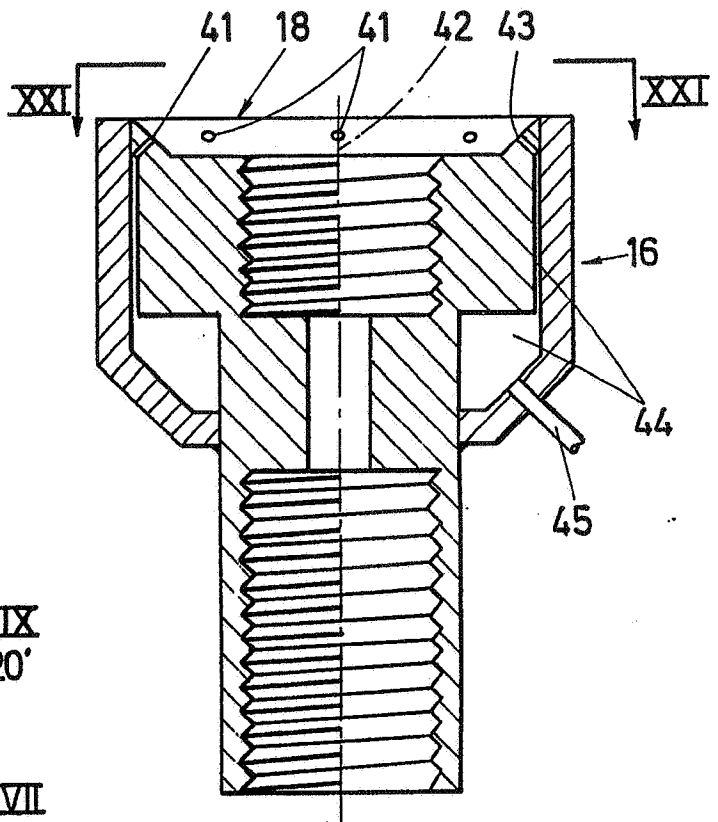


Fig.20.

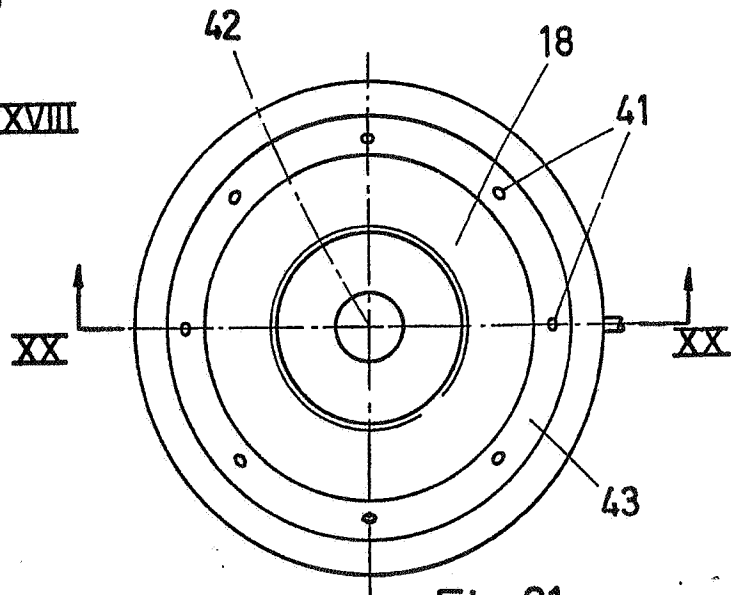


Fig.21.